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JOURNAL

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OF THE

MASSACHUSETTS ASSOCIATION

OF

BOARDS OF HEALTH

An Official Quarterly Record of
Information for the Public

OCTOBER, 1898

Proceedings of the July Quarterly Meeting

Subjects: Disposal of Sewage — Quarantine Department of Boston — Release of Diphtheria Cases

BOSTON
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VOLUME VIII NUMBER 3

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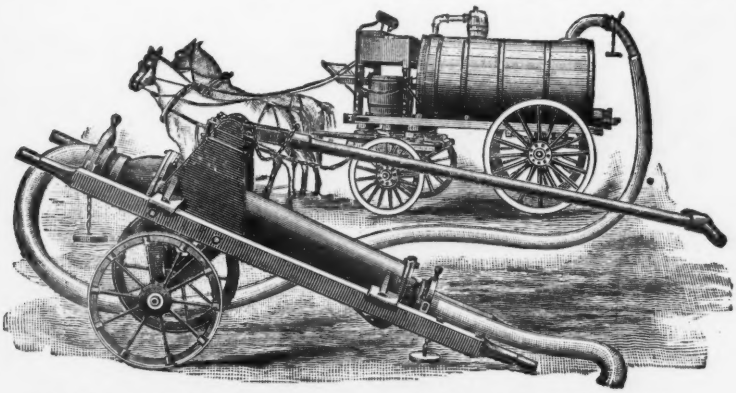

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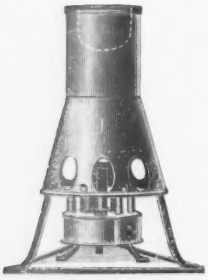

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JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

July Meeting, 1898

SUBJECTS: Disposal of Sewage of Small Villages, Public Institutions, Factories, etc. — The Quarantine Department of Boston — On the Regulation requiring Two Consecutive Negative Cultures for the Release of Diphtheria Cases

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THE JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH was organized in Boston in March, 1890, with the following objects: the advancement of sanitary science in the Commonwealth of Massachusetts; the promotion of better organization and co-operation in the local Boards of Health; the uniform enforcement of sanitary laws and regulations; and the establishment of pleasant social relations among the members of the Association.

All persons holding appointments as members of a Board of Health in a Massachusetts city or town, the executive officers of such a local board, and the members of the State Board of Health are eligible to membership. Other persons may be elected members by vote of the Association. The annual dues are one dollar and fifty cents, and should be paid to the Treasurer, James B. Field, M.D., 329 Westford Street, Lowell, Mass.

The Association holds four regular meetings each year, the annual or January meeting always being held in Boston.

THE OFFICIAL JOURNAL OF THE ASSOCIATION is a quarterly publication, containing the papers read at the meetings, together with verbatim reports of the discussions following them. No part of this matter is printed in any other periodical.

The JOURNAL will present, from quarter to quarter, a fair and adequate picture of the progress of practical sanitary science as applied to the needs of a modern community. The various subjects which are reviewed in the quarterly meetings of the Association are treated by experts qualified to speak from daily experience in Public Health offices, who, as men of science, are careful to be scientific and comprehensive, and who, as public officers, are no less careful to speak pertinently and so as to be easily intelligible to the layman.

The JOURNAL, in a word, appeals to all whose interests touch the questions of sanitation and hygiene,— to the architect, the school-committee-man, the manufacturer, the contractor, and, above all, to the busy practitioner who has no time for any reading but what is brief and to the point.

The subscription price of the JOURNAL is one dollar a year, payable in advance. Single numbers, twenty-five cents. It is on sale at the Old Corner Bookstore, and at Smith & McCance's Bookstore, 57 Bromfield Street, Boston.

All communications to the Association should be addressed to the Secretary, **EDWIN FARNHAM, M.D., City Hall, Cambridge, Mass.**

Subscriptions and all business communications should be sent directly to the publishers,

SMALL, MAYNARD & COMPANY,
6 Beacon Street, Boston.

JOURNAL OF THE

MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

VOL. VIII. October, 1898. No. 3

JULY MEETING

OF THE

Massachusetts Association of Boards of Health.

The quarterly meeting of the Association was held at Gallop's Island, Boston Harbor, on the afternoon of July 28, 1898. In the absence of the President the meeting was called to order by Dr. S. H. Durgin, Vice-President, who said:—

The following names have been handed in and recommended by the Executive Committee for membership in the Association.

WALTER C. KITE, M.D.	Milton.
FRANK T. HARVEY, M.D.	Clinton.
F. W. KENNEDY, M.D.	Lawrence.
A. E. MERRILL, M.D.	Somerville.
T. J. ROBINSON, M.D.	Taunton.
C. W. HARLOW, M.D.	Melrose Highlands.
D. R. BROWN, M.D.	Salem.
ARTHUR HUDSON, ESQ.	Newton.

The above-named gentlemen were elected to membership.

THE CHAIRMAN.— For good reasons we will omit the reading of the records of the last meeting. The next on the programme is

Incidental Business. Has any one any business to bring before the Association at this time? If not, we will listen to a paper by X. H. Goodnough, Chief Engineer of the State Board of Health, on the "Disposal of Sewage of Small Villages, Public Institutions, Factories, etc."

DISPOSAL OF SEWAGE OF SMALL VILLAGES, PUBLIC INSTITUTIONS, FACTORIES, ETC.

BY X. H. GOODNOUGH, CHIEF ENGINEER STATE BOARD OF HEALTH.

With the rapid growth of urban population which began in Massachusetts some fifty years ago came the necessity of general systems of public water supply. For many years these supplies were confined to the cities and large towns; but the great advantages to a community of a satisfactory modern public water supply were quickly appreciated by the smaller communities, so that, while in 1870 there were but 20 cities and towns in the State having modern public water supplies, the number at the end of the year 1897 was 160. At the present time 120 out of the 130 towns in the State having a population by the census of 1895 in excess of three thousand persons are provided with public water supplies, and no less than 40 towns having a population of less than three thousand are provided with such supplies.

The accessibility of an abundance of water under high pressure has caused a great increase in the number and variety of water fixtures, and there has been a general and rapid increase in the quantity of water used per inhabitant in the cities and towns in which public water supplies have been introduced. With the far greater amount of water used, old methods of disposal of the household sewage and wastes became inadequate in thickly populated districts; and the introduction of general systems of sewerage, especially in the larger towns, soon followed the introduction of public water supplies.

The general method of disposing of the sewage in the beginning was to discharge it into the most convenient body of water, in many

cases into streams which were used farther down as sources of public supply, the users of the water being comforted with the assertion that running streams purified themselves. There being some doubt, apparently, as to how great a distance a stream must run before becoming purified, the legislature decided in 1878 that no sewage or other polluting matter should be discharged into any stream used as a source of water supply or upon whose banks a filter gallery so used was situated within twenty miles above the point from which the supply was taken.

While this law afforded much protection against the pollution of public water supplies, there was nothing to prevent the pollution of streams or other bodies of water not affected by the act; and it was found in some cases that the discharge of sewage into a stream or tidal estuary resulted in creating a very serious nuisance, so that it became evident that some more satisfactory method of disposing of the sewage was necessary and that something more definite must be done for the protection of the purity of public water supplies and inland waters and for the disposal of sewage.

In 1886 the legislature directed that the State Board of Health should have general oversight and care of all inland waters, and all cities and towns, corporations, firms, or individuals either having or intending to introduce systems of water supply, drainage, or sewerage, were required to give notice to the board of their intentions, and to submit for its advice outlines of their proposed plans or schemes relating to water supply or sewerage. The board was also authorized to make experiments to determine the best practicable methods for the purification of water, drainage and sewage, and the disposal of the same, and was authorized to employ such expert assistance as might be necessary.

Experiments upon the purification and disposal of sewage and the purification of water were begun at Lawrence under the direction of Mr. Hiram F. Mills, a member of the board, in the early part of the year 1888; and it is my intention to give a brief summary of these experiments so far as they relate to the purification of sewage by intermittent filtration through sand or gravel.

Previous to these investigations very little was definitely known anywhere as to the purification and disposal of sewage. In some

places in the Old World the sewage of cities and towns was disposed of upon land; but very little was definitely known as to the conditions most favorable for the purification of sewage by any given material, and there was much doubt as to whether it could be purified at all. The portions of the experiments relating to the filtration of sewage were conducted chiefly for the purpose of determining the fundamental principles of filtration not previously established and to learn what could be accomplished by filters made of some of the widely varying materials found in suitable localities for filtration areas, and to learn from these results the probable efficiency of other materials to be found throughout the State.

Several circular tanks, 17 feet 4 inches in diameter and 5 feet in depth, having an area of $\frac{1}{200}$ of an acre, or a little over 200 square feet, were filled with soils of various kinds selected from lands which might be used for sewage disposal purposes. It was soon found that some of the soils, such as those found in our meadow lands and the mingled gravel and clay of some of our hillsides, which is known as hardpan, were of such an impervious nature that little or no sewage could be made to pass through them. Black loam and the brown garden soils are also, when they are fine, useless as filters for purifying sewage; but the gravels and sands, from the coarsest almost to the very finest, are found to be capable of purifying effectually sewage applied to them in various amounts, depending upon the size of the particles of the material.

From these investigations it was soon found that the purification of sewage by filtration through sand depended upon applying the sewage intermittently, so that air was allowed to enter the filter between the times when sewage was discharged upon it. The organic matter in the sewage was thus converted to mineral matter, and passed off in the effluent.

Four of these filters have now been in operation for ten years, and two others for periods of seven years; and sewage has been applied to them, practically, continuously up to the present time. The soil placed in the different filters was of various composition, varying from small gravel stones to the very fine river silt found in the valleys of some of our rivers, which looks in its natural state like dust. To the filter containing the finest material there is now being

actually applied an average of 600 gallons a week, equivalent to a little less than 20,000 gallons per acre per day; while the coarser and more favorable materials for sewage purification will pass about three times this quantity of sewage, or about 300 gallons per day, equivalent to 60,000 gallons per acre per day.

The main body of sand in these filters has never been disturbed since the filters were started; but the solid matters tend to collect in the upper layers of the filter, and it is necessary to disturb the surface about once a week by raking. Once or twice a year spading is necessary to a depth of from six to eight inches. Occasionally some of the clogged sand from the surface is removed and replaced with clean sand, but this has not been necessary for five years.

The effluent from these filters has been carefully examined; and, with the very strong sewage of the city of Lawrence which is applied to the tanks, more than 90 per cent. of the organic matter has been removed during the past year, and more than 99 per cent. of the bacteria.

As a result of the experience gained in these and similar experiments, the board has been able to give definite advice to cities and towns with reference to the purification of sewage; and many of the cities and towns of the State now purify their sewage by filtration upon land, and produce a clear and colorless effluent, which has no unfavorable effect afterward upon the appearance or odor of the water into which it may be discharged.

The principles which have been found successful in disposing of the large quantities of sewage produced in the larger cities and towns have also been successful when applied to very small communities and to hospitals and other public and semi-public institutions. Several such institutions, in which the population ranges from 200 to 1,200, now purify their sewage by intermittent filtration. In fact, this method of sewage disposal has been successfully used for buildings containing as small a number as twenty persons.

It also sometimes happens that, in providing a general sewerage system for a town, a few thickly settled streets, lying perhaps in another watershed, must be omitted from the general scheme; and it has sometimes been the case that such districts are compelled to go without sewerage facilities until the population has increased suffi-

ciently to warrant the expenditure necessary in connecting the districts with the general sewerage system of the town. In such cases it is often feasible to provide sewerage facilities for the district by preparing a small filtration area for the disposal of the sewage until the growth of the district may warrant its connection with the main system.

In some cases the necessity of pumping sewage to a higher level in order to purify it has prevented the undertaking of a necessary sanitary improvement, but the recent introduction of oil and gas engines of great economy in operation may prevent the necessity of pumping from being in the future a matter of such serious consideration as it has been in the past.

To successfully purify sewage by filtration through sand, it is necessary, as already stated, that the sewage should be applied intermittently. Moreover, it is very desirable, in designing the works, to so construct them that they can be operated with the least possible care. For these reasons it is desirable that sewage be discharged upon a bed in considerable quantity at intervals rather than it be allowed to flow continuously for a considerable time. Especially is this true in the winter season, when, if a small quantity of sewage is allowed to flow steadily upon a filter bed, there is much more danger of trouble from freezing than if the sewage is discharged in considerable quantity. Little difficulty is experienced in disposing of sewage by filtration in the winter season, even in the coldest parts of the State, if the filter beds are properly prepared and operated. To secure intermittency in the operation of the filters, it is the custom in gravity systems to provide a collecting or flush tank so arranged that it will discharge its contents automatically at intervals through the twenty-four hours.

In most of the larger systems of sewage disposal the sewage arrives at the filtration area after flowing considerable distances through the sewers and often after being stored in a reservoir and pumped through a long force main, so that the solid matters are in a finely divided state and the sewage is considerably decomposed; but the sewage from the hospitals and public institutions is usually fresh, and, in applying the fresh sewage to a filter, a greater proportion of the organic matters will accumulate upon the surface or in

the upper layers of the filter than in the case of stale sewage, in which the organic matters have decomposed to a greater extent and much of the nitrogen is in such a form that it enters the filter in a state of active decomposition, and passes off as harmless mineral salts in the effluent.

It is practicable to remove much of the organic matter from sewage by sedimentation, chemical precipitation, and various mechanical means; and a greater quantity in proportion can be removed from fresh than from decomposed sewage. If a satisfactory method of disposing of sludge is available, the area of filters can be reduced by removing the solid matters from the sewage before discharging it upon a filter.

These and other matters of detail must be considered in connection with the circumstances of the location of the buildings from which sewage is to be taken and with reference to the location of the proposed filter beds or disposal works.

For the present each new problem is apt to present new engineering features, and it is difficult to make rules as to details of construction of works for sewage purification on a small scale that would be generally applicable. Moreover, while the general principles of sewage purification are now well known, the investigations of the board and the results of the practical operation of filters now in use in various places are constantly furnishing new information as to results obtainable by filters of different construction, and as to different methods of operation and of treatment of sewage before filtration.

One of the chief causes of pollution of many of our streams has been the sewage from factories. Tanneries, paper-mills, and wool-scouring establishments are prominent among the manufacturing establishments which produce large quantities of manufacturing sewage; and a factory in either of the industries mentioned may produce as much sewage as a large town, and the organic matter in the sewage of some of them may be several times as great as an equal volume of domestic sewage, so that the purification of such sewage is as important in protecting the purity of streams in many cases as the purification of domestic sewage of a town.

The problem of the purification of manufacturing sewage has re-

ceived special attention by the board; and much interesting, valuable information has been obtained from experiments with reference to the purification of sewage of this character.

In the investigations as to purification of sewage from such establishments it has been found in some cases that the sewage can be purified by filtration in a manner similar to the methods of purifying domestic sewage. But careful analyses of manufacturing sewage have shown that in some cases the chemicals used in the manufacturing processes are of such a kind as would destroy nitrification if the sewage should be applied to an ordinary sewage filter directly as it comes from the factory. Ordinary methods of chemical precipitation also have little effect upon some kinds of manufacturing sewage. Where mingled with a sufficient quantity of domestic sewage, however, manufacturing sewage can generally be purified readily by methods that are successful in the purification of domestic sewage; but, where the manufacturing sewage alone is to be treated, these methods may or may not be applicable. For instance, an examination of the sewage of two tanneries showed that the sewage of one of them could be easily purified by filtration through sand after the heavier organic matters, or sludge, had been removed by sedimentation or other means; while in the other, doing practically the same kind of work, a chemical was used which, practically, wholly prevented nitrification, and sewage could not be purified until the effect of this chemical had been neutralized.

Recent examinations of paper-mill sewage show that the polluting matters are of a carbonaceous rather than nitrogenous character, so that the pollution may perhaps be removed better by straining or some form of precipitation than by filtration.

A wool-scouring establishment of considerable size may use as much as a million gallons of water a day in the various processes; but only a comparatively small portion of the total outflow comes from the scouring process, the greater portion being water used in rinsing. The investigations thus far made indicate that it is practicable to purify sewage from such establishments to a sufficient extent to prevent its seriously polluting a stream into which it might be discharged.

Our investigations show in general that, while it is feasible to

purify the sewage from manufacturing establishments of these kinds at least, there is such a wide variation in the quality of the sewage that it is impracticable as yet to prescribe a general method of purifying such sewage. It will therefore be seen that it is very necessary, in seeking to prevent nuisances due to manufacturing sewage, to learn definitely in each case the nature of the problem with which it is proposed to deal before prescribing a remedy therefor.

THE CHAIRMAN. The importance of this paper is readily seen by every board of health. There are frequently found instances where in the absence of sewers the cesspool is used, the overflow from which makes almost as great a nuisance as if the flow had been directly upon the ground without the cesspool. In the outskirts of cities and throughout towns this state of things will be found, and it has often occurred to me whether or not the filtration system which is practised on a large scale may not be utilized on a very small scale; and, instead of the overflow of the cesspool going directly into the brook or river, it may be filtered, and the effluent water from the filter go into the brook or river without any harm. With the purpose of bringing this question before the Association, I have asked for this paper to be prepared by a competent engineer.

The paper is open for discussion, and I have no doubt Mr. Goodnough will be willing to answer such questions concerning this process as members may be disposed to ask. I will call on Professor Kinnicutt, of Worcester.

PROFESSOR KINNICUTT.— *Mr. President and Gentlemen of the Association.*— There is one thing in Mr. Goodnough's paper to which I think he did not draw sufficient attention, and that is the work that has been done by our own State Board of Health. I have been more or less connected with sewage work since 1881. In 1883 Worcester was obliged to purify its sewerage before emptying it into the Blackstone River. Before that time there was very little accurate information that we could gather in regard to the best method of treating sewage; and Worcester at that time decided, after careful inquiry and research both in this country and in England, to provide itself with a system of chemical precipitation. Now, if Worcester

to-day had the same problem before it, it would immediately turn to the work which has been done by our own State Board of Health, and the method of the purification of sewage would be very different from that instituted in 1883; and what is true of Worcester can be said of every city and every town in our own State. To-day, owing to the work by our own State Board of Health, we are in a position to know with a fair degree of accuracy what is best to do in various cases.

Now, regarding the purification of sewage of smaller towns, I perfectly agree with your President that I see no reason why the sewage of even our smaller towns cannot be purified comparatively cheaply by intermittent filtration. Your attention has been called to experiments made by the State Board of Health on various kinds of soil, and he might also have said that not only have experiments been made with various kinds of soil, but also with other material; and I think that he will agree with me when I state that any rough, jagged material which is more or less porous can be used for filter beds. Such substances, for instance, as cinders or coal or coke or even burnt clay, are used with success in filter beds, and small filter beds can be made with these materials at comparatively little expense; and, further, with the domestic sewage of most of our county towns I think that we could filter very much larger quantities of sewage on an acre of prepared filter beds than 60,000 gallons per day. I think with most domestic sewage of our small country towns and villages that we might be able certainly to filter and purify sufficiently 200,000 or, possibly, 500,000 gallons a day per acre; and certainly, if we could do that, the expense for our small towns or for hospitals or public institutions would not be very great.

The only trouble that I find with intermittent filtration, especially of domestic sewage, is in winter. I think this can be overcome by careful attention, and the only criticism that I should make in regard to the work of our State Board of Health is that they do no supervising work. The experiments at Lawrence have shown what can be done; but, unfortunately, many of our towns which have put in intermittent filtration beds, after they have once established them, have not looked after them with sufficient care. It seems to me

that the State Board of Health should not only conduct experiments, but should have certainly one experienced man in the field to go to these various towns, and instruct the men who are in charge as to the best way of managing the filter beds. It seems to me that, if the filter beds on a large scale, such as at Marlboro and at Gardner, were supervised a little more carefully, especially in the winter and in the spring months, the results which would be obtained would be a great inducement for other towns to use the same method of purification. [Applause.]

THE CHAIRMAN.— Has any one else a word to say on this question? If there is nothing more to be said, I will ask Mr. Goodnough to close the discussion.

MR. GOODNOUGH.— There is one matter to which Mr. Kinnicutt called attention; that is, the lack of care of some of the filter beds in the State. There is no doubt there is some lack of care of some filter beds, especially in the winter season, but I do not think that it is very general; and, moreover, care is not so necessary in the winter season. The stream into which the effluent may flow has a very much higher flow in winter than it has in the summer. Perhaps, considering the portions that are purified and partially purified, about as little pollution is discharged into the streams in the winter as in the summer in proportion to the flow of the stream. It is also to be remembered that the board has little or no control of some of these city and town filter beds in the State. We have the approval of the plans of town authorities. There is usually a clause in the act which says that, if any pollution is caused to a stream by a sewage effluent, the attention of the State Board of Health shall be called to it, and the board shall do certain things to remedy it. I know of only one instance in which the board has been requested to take any action on account of badly prepared filter beds. This was in the case of a town which certainly has not taken care of its filter beds. I read in the town report of that town the other day, in relation to the construction of the works, that in one year it was decided to dispense with the services of an engineer. In the report for the next year it was stated that for some unaccountable reason

there were 300,000 gallons of water leaking into the sewers, and an engineer was consulted as to how to keep it out. The leakage caused the quantity of sewage to exceed the capacity of the filter bed, which was not the fault of the board, as we had absolutely no control over the construction of the works.

PROFESSOR KINNICUTT.— I did not mean to criticise the board. I only wish the board had the right to go to the various towns and enforce what rules they thought proper.

THE CHAIRMAN.— The next paper in order is a "Brief Account of Quarantine Experiences," by Dr. Paul Carson, Port Physician of Boston.

QUARANTINE DEPARTMENT, CITY OF BOSTON.

BY DR. PAUL CARSON, PORT PHYSICIAN.

The necessity for examining and quarantining vessels for contagious diseases first became apparent in the earlier years of the present century. The old-time sailing packets plying between this country and foreign ports were often long overdue. The food and water supply (never over-abundant) would run short; and the passenger, having been subjected to the hardships of a long voyage, together with the bad sanitary condition of these vessels, easily succumbed to any contagious disease that might have gained entrance. Typhus seems to have been the principal offender, and vessels have been known to lose half their passengers in a single voyage.

The continued arrival of vessels in this condition was a constant menace to the health, not only of the port of arrival, but of the country at large through which the passengers might travel. Several of our large seaport cities suffered from severe epidemics of typhus and small-pox directly traceable to the shipping. To the local governments of these cities who took means to prevent them we owe our present system of quarantine.

Previous to 1893 there had been no uniformity in the conduct of the various quarantines. Each formulated its own rules, and carried

them out in its own manner. Some were extremely efficient; others, the exact reverse. In that year this country was threatened with cholera, as nearly every continental port was infected. The impending danger being so great, the surgeon-general, M. H. S., called a meeting of all the prominent quarantine officers of the country to confer with regard to the best means of preventing, not only cholera, but the other contagious diseases. As a result of this conference, a set of regulations were made, which were to form a basis for all quarantines. Congress at about the same time authorized the sending of medical men to foreign ports to inspect the passengers and cargoes of vessels bound to this country, and also provided that every vessel bound for this country should have a bill of health from the United States consul, making the captain who failed to comply with this regulation liable to a heavy fine. The bill of health is a very important document to the health officers. It states the name, nationality, and rig of the vessel, the number of passengers, if any, number of crew, source and wholesomeness of food and water supply, number and character of cases of diseases that have occurred during the previous voyage, and, furthermore, the number and character of the quarantinable diseases that have occurred at the port of departure for two weeks previous to the time of sailing.

At this port we board all vessels from foreign ports with the exception of the British Maritime Provinces. From June 1 to November 1 all vessels from ports south of Virginia are inspected, this latter inspection being necessary to guard against the epidemics of yellow fever that occur from time to time along the Southern coast.

The hours for boarding are from sunrise to sunset, and all vessels are boarded with as little delay as possible. Immediately after boarding the vessels, papers are examined,—for all practical purposes, the manifest, crew-list, and bill of health are all that are necessary. The captain is then questioned as to whether any sickness or deaths have occurred during the voyage; and, if so, the ship's log is examined, to make out, if possible, their character. If the answers are satisfactory, an inspection is then made of all the quarters; and, by the time this is completed, the crew and passengers (if any) are mustered and ready for examination. For the crew, this examination consists merely in a careful scrutiny of each individual and a

careful count to see that none are absent. The steerage passengers are then made to pass in single file before the physician with their vaccination ticket in hand. If any do not have these, they are made to stand to one side; and an examination into the cause of the absence is made. If, after the inspection has been made, everything is found to be in good condition, a certificate to that effect is given, so that the vessel may enter at the custom-house.

The quarantinable diseases, according to the United States regulations, are cholera, yellow fever, typhus, small-pox, leprosy, and bubonic plague. In addition to these we remove scarlet fever, chicken-pox, typhoid, and measles.

A vessel arriving with any one of the latter diseases, unless there is an epidemic, is allowed to depart after the removal of the case, providing, of course, that it has been promptly isolated. The disinfection of the hospital is left to the medical officer, if he is known to be reliable.

A vessel arriving with cholera on board or from a port infected with this disease is immediately sent to an anchorage within the quarantine limits, all the passengers and crew are removed and bathed, and their clothing and hand luggage sterilized, after which they are allowed to enter the houses of detention. Here they are carefully inspected each day, and no communication is allowed between the various houses. If any cases appear, they are immediately isolated. At the end of twenty-one days from the last possible chance of infection, if they are well, they are released from quarantine. This period covers the incubation of the disease; and, while it seems somewhat long and more or less of a hardship, yet, when we consider the severe financial loss which would follow the paralysis of commerce due to an epidemic of cholera, we take a different view of the matter.

After removing the crew and passengers, the vessel receives attention. It is first rendered mechanically clean, or as nearly so as possible. Then every part of the vessel which can by any possible means have become infected is washed with an acidulated solution of mercuric-chloride, 1 to 800. On any parts where mercury would have a bad effect a solution of formalin is used. All bedding, carpets, and fabrics of any kind are sterilized with steam at a temper-

ature of 220 degrees Fahrenheit for thirty minutes. The water tanks are emptied, and washed with a 2 per cent. solution of potassium permanganate. After everything has been thoroughly dried, all the saloons and quarters are fumigated with formaldehyde for six hours, a pint of the 40 per cent. solution being allowed for every one thousand cubic feet.

For yellow fever the treatment of passengers and vessel is the same as for cholera, except that the detention is but for six days. A vessel having small-pox on board would be allowed to depart after disinfection and fumigation, bathing and sterilization of the baggage. Only those who are sick or who cannot show satisfactory evidence of vaccination are detained.

THE CHAIRMAN.— The paper is open for discussion.

DR. COGSWELL.— Mr. Chairman, I should like to inquire — take an average year — how many people are taken from ships in Boston Harbor?

DR. CARSON.— From twenty to fifty.

THE CHAIRMAN.— It is understood by this that many people are taken off vessels for observation without actually having quarantinable diseases,— taken off under suspicion, and held until the diagnosis can be made. I fancy there are a great many members present from inland towns and cities who are not familiar with the routine work of the quarantine, and the port physician will be very glad to answer questions which you may choose to ask. I have just been asked the question "In the case of an infected ship, are the patients taken off or the others?" They would all be taken off. The thing to do in such an instance is to clear your vessel, and place the well people by themselves, watch them daily for symptoms until the period of incubation is gone, and then get rid of them, taking the patients by themselves to a hospital. As soon as the vessel has been cleared of all the people, we can properly disinfect it and start afresh. Are there any other questions to be asked concerning this paper?

DR. MILLER.— Mr. Chairman, some of us would like to know the best method at the present time of disinfecting ships. What method is pursued for disinfecting?

THE CHAIRMAN.— Washing down decks and all surfaces is done here with a strong solution of chloride of mercury, 1 to 500. Clothing and all fabrics which may be treated with steam, without injury, are placed in the steam plant at the island, and treated in that way. Such things as may not be steamed without injury are treated with a 5 per cent. solution of carbolic acid or a 2 per cent. solution of formalin. A chloride of lime solution, say a quarter of a pound or half a pound to a gallon of water, makes a very good solution for washing down decks and hospital floors and other places which are infected. The formalin gas is used in rooms, but it has no power to penetrate. It is only for surface work.

Are there any other questions? If not, we will proceed to the next paper, "The Need for Two Negative Cultures on Release of Diphtheria Patients," by Dr. H. W. Hill, Director of the Laboratory Boston Health Department.

ON THE REGULATION REQUIRING TWO CONSECUTIVE NEGATIVE CULTURES FOR THE RELEASE OF DIPHTHERIA CASES.

BY DR. HIBBERT WINSLOW HILL,

DIRECTOR OF THE BACTERIOLOGICAL LABORATORY OF THE BOSTON HEALTH DEPARTMENT.

Mr. President.— The Boston Board of Health has incorporated among its rules a regulation affecting the release from isolation of convalescent cases of diphtheria, which reads in part as follows: — . . . "Two consecutive cultures shall prove negative . . . after the disappearance of the false membrane before the case is pronounced free from danger or further isolation pronounced unnecessary."

The Diphtheria Diagnostic Service of the board having been entrusted to me early in May of this year, I wish to present to you the results obtained since that time, in so far as they illustrate the rational basis and practical value of this regulation. You will perhaps pardon me if I review the situation briefly.

The Diphtheria Diagnostic Service is carried on by the Board of Health with two specific objects in view: on the one hand, to afford to the physicians of the city a method of diagnosis, the most readily available and accurate which is at present known for this disease, without additional expense to themselves or to their patients; on the other hand, to afford to those officers of the Board of Health whose special work is the control of contagious diseases the best and, indeed, the only means for determining the time at which isolation may be safely ended. To the physician the *diagnostic* side of the work is chiefly valuable, since it assists him in cases of doubt, and in all cases relieves him of the responsibility for the decision reached. To the Board of Health the chief value lies not so much in the occasional discovery of a diphtheria case which would otherwise have been overlooked, — the most brilliant of the services it renders, — but rather in the prosaic routine of the release work; that is, the work of determining the disappearance of the bacilli after the case is, clinically, a thing of the past.

The extent to which physicians avail themselves of this service sufficiently demonstrates their appreciation of the diagnostic side of the work and their confidence in it. But the remarks appended to the cards sent in to us with the cultures taken from convalescent patients show that the regulation with regard to release quoted above fails to arouse enthusiasm — to put it mildly — in the minds of either the physician or his patient, at least in those cases where the bacilli persist an unusually long time. It is of course easy to understand that it seems a hardship to continue the isolation of a recovered patient, and one certainly sympathizes with the physician who sees in prospect an apparently unending succession of blue cards* as the only response to his equally unending series of cultures. Apart from the weary waiting involved, the physician chafes also under what he or his patients sometimes regard as an implied reflection on his skill, the delay in official release after he has declared the patient fully recovered appearing as a reversal of his decision. This idea is based on a misconception so obvious and simple that it would be unworthy of mention, were it not so wide-spread.

* The notification to the physician of the *presence* of the bacilli of diphtheria is given by cards printed in blue, the absence of the bacilli by cards printed in black.

The mistake consists in supposing that the Board of Health considers the continued presence of the bacilli of diphtheria as showing the continued presence of the disease of diphtheria. Such a position would not be tenable by any authority, because it is contrary to all the accepted facts and accumulated experience of workers since the diphtheria bacillus was first discovered. The Board of Health bases its demand on a totally different ground. It is prepared to admit that in many cases the convalescent patients from whose throats positive cultures continue to be obtained may be fully recovered from the disease. But it is equally convinced that these same patients, while perfectly well themselves, may — and, if positive cultures are obtained from them, do — constitute foci from which the disease may spread, and that for the great good involved in the protection of the public health the patient must continue to suffer the relatively small evil of isolation until he is not only recovered, but also non-infectious. Up to that time the same isolation is enforced as during the progress of the disease itself. From the standpoint of public sanitation, in short, the case must continue to be regarded as a case of diphtheria, although from the clinical standpoint the patient's own condition of health may be perfectly normal.

I do not think it requisite to defend the position that it is both necessary and valuable to consider the disappearance of the bacilli as determining the limit of infectiveness of this disease. The fact that the great majority of diphtheria cases are infective until the bacilli disappear is too widely established to give room for discussion at this time; but the exact amount of bacteriological evidence necessary to establish the fact of the disappearance of the bacilli is another question. Taking it as established that patients with diphtheria bacilli in their throats are infective, it becomes a matter involving considerable responsibility for the authorities officially in charge of the public health to decide just when the bacilli have in fact disappeared, and the patient is therefore really no longer capable of transmitting the disease. The evidence afforded by a single negative culture has been widely relied on to determine this point, and regulations requiring even a single negative for release constitute a great advance on previous precautions. Tobiesen in 1892

was able to demonstrate that 24 out of 46 patients or over 50 per cent., discharged from hospitals, under then existing conditions, were still infective. Yet it is easy to show that, where one negative culture only is demanded before the patient is released, infective cases may still be set free, and that in a sufficiently large percentage of cases as to constitute a very appreciable degree of menace to the public health.

The reasons why a single negative culture for release is of less value in showing the absence of the bacilli than two such negative cultures are not far to seek. To begin at the beginning, and with a proposition which hardly needs statement, a negative culture taken for diagnosis is of less value as evidence than a positive culture, simply because in the nature of things it is more difficult to demonstrate a negative than a positive. If the bacilli are present in a culture when it is examined in the laboratory, there can be little doubt that they were present in the throat from which the culture was taken, provided, of course, that the technique employed was not outrageously improper; but the absence of the bacilli from a culture is not such a matter-of-course demonstration of their absence from the throat, even supposing the technique employed to be of the best. The sources of error involved are too numerous to justify giving the same weight in reaching a decision to a negative culture as to a positive culture. The bacilli, although present, may have failed to reach the swab; or, reaching the swab, may have failed of effective transfer to the serum; or, reaching the serum, may have failed to grow or have been overgrown by other forms; or, developing properly, may yet have failed of transfer to the slide placed under the microscope; finally, even bacteriologists are not infallible, so that the bacilli, although present on the slide, may have been missed in going over the slide with the microscope. Nevertheless, it is true that, granted a careful technique at every stage, a negative culture, despite these qualifications, is usually good evidence of the absence of the bacilli when the culture is taken for diagnosis; that is, in the early days of an attack, when all the symptoms are well marked. Why, then, should it not be equally valuable, when taken for release? There are good reasons to offer. In the first place the average degree of care exercised in taking a culture for diag-

nosis at the time when the physician is naturally most anxious about the case is greater than the average care in taking cultures for release, especially if both physician and patient fail to appreciate the value of the process, and therefore go through with it perfunctorily, even unwillingly, feeling it an unnecessary and troublesome requirement,— a piece of departmental red tape. I do not wish to imply that all or even the majority of physicians feel thus, but I have evidence to show that some of them do. Apart from this, also, a culture for release presents a more difficult problem to the most careful and conscientious operator than does a culture for diagnosis. The membrane which previously formed a guide to the proper point which the swab should reach has vanished. The bacilli are probably fewer in number than they were when the membrane was present, and have also become scattered. At the particular moment when the culture is taken they may have disappeared temporarily from the surface of that part of the mucous membrane reached by the swab, only those remaining which are ensconced in folds or follicles or other inaccessible recesses, from which they may emerge later. It is not necessarily a reflection on the technique of the operator that a culture from such a case should prove negative, while a subsequent culture proves positive. The most experienced culture-takers may sometimes fail under such circumstances. Theoretically, then, it is obvious that, while a single negative culture for diagnosis may be accepted as reasonably likely to represent the true state of affairs, a single negative culture for release is a comparatively flimsy protection against the possibilities of infection involved in setting at liberty persons retaining virulent bacilli in their throats. This is the real basis of the demand for two negative cultures. It is not claimed that the danger is entirely removed by the use of the second negative, but it certainly is very much reduced. It is true that we can produce good evidence and excellent authority for the statement that it would not be unreasonable to require three, or even more, negatives for release. Indeed, this is the practice in the contagious diseases department of the Boston City Hospital, under the highly respected authority of Dr. McCollum. The practical difficulties in obtaining more than two negative cultures in public work, however, are such that, for the present at least, two negatives are accepted for release by our board.

So much for the reasons which led to the establishment of the regulation. I will now present briefly such actual results in practice as bear on this point based on cases examined during the ten weeks beginning on the 10th of May last.

The number of cases examined during this period which gave positive results, and which went on to final release in my hands or were otherwise disposed of, reached 68. Thirteen of these cases, or nearly 20 per cent., yielded, at some time or other during their course, single negative cultures followed by positive cultures. In other words, 20 per cent. of the total positive cases would have been released while still infective, had release on single negatives been the rule.

The length of time which elapses between the first single negative and the last positive culture in any given case represents the length of time during which that case would have been at large and infective under the old rule,— a total period of eighty-four days for the 13 cases quoted. But it is unreasonable to suppose that the bacilli promptly and invariably disappear immediately on the taking of the last positive culture. It is equally unlikely that they always remain in the different throats just up to the date of the first of the two final negatives. Perhaps it is not unjustifiable to suppose that they are present on an average for one-half of the intervening time. This would make the total length of time during which the bacilli were present in these 13 cases, after the first single negative, one hundred and one days, or nearly eight days for each patient. In other words, the introduction of the second negative has, in the last ten weeks, effected a reduction in exposure of the public to infection equivalent to that involved in the release of 20 per cent. of the total positive cases a trifle over one week too soon.

In justice to this subject, I must, however, call attention to the fact that these figures, convincing as they are, do not put the matter in its most favorable light. The calculations so far given are designed to show the actual results based on positive cases of all kinds,— cases which terminated in death or were removed to hospitals or in other ways failed of termination in release at our hands, as well as cases systematically completed by a full set of cultures. A second calculation is necessary, in order to demonstrate the real

value of the second negative. In the calculations already given rather more than one-third of the 68 cases were incomplete; and I have hitherto assumed for convenience that none of these — about 27 in all — would have shown single negative followed by positive cultures, had they been completed. I have, however, no real basis for this assumption. On the contrary, those 41 cases which were systematically examined until two consecutive negative cultures were obtained show a total of 12 cases giving single negatives followed by positives, or, practically, 30 per cent. In other words, while the number of cases showing what may be termed "premature negatives" forms 20 per cent. of the whole number of positive cases, they form no less than 30 per cent. of the cases officially released by us. Practically, then, nearly one case in every three officially declared non-infective would still retain the bacilli, did we accept a single negative culture for release.

In conclusion, I wish to add that, although these figures are based on about six hundred examinations only, and all the calculations must therefore be regarded as rough approximations, I feel little doubt that a year's further experience of the second negative will yield evidence of no less favorable character. I have not attempted even to touch upon many of the interesting and valuable points which relate to the important subject of release by culture, and especially by two consecutive negatives. My principal object has been to demonstrate simply certain actual facts already established.*

THE CHAIRMAN.— If there should be a board of health within the State of Massachusetts that has had no trouble in the discharge of convalescents from diphtheria, we should be glad to hear from it. I fancy, however, all boards have had the same kind of trouble we have had in Boston. We were formerly very glad to get the first negative, and particularly in cases which linger so long after the clinical appearances have disappeared; but we have been convinced that this method of release was wrong, and that we oftentimes did discharge patients before they were free from diphtheria bacilli.

*Since this article was written, about six hundred additional examinations have been made, exactly 40 per cent. of those officially released by two consecutive negative cultures yielding single negative cultures followed by positive cultures.

The paper is open to discussion, and I hope that every one will express his views on this question.

MR. NEWCOMB.— Mr. Chairman, is it understood that you require two negative cultures in every case before you release the patient?

THE CHAIRMAN.— Two negative cultures in succession before release.

MR. NEWCOMB. — What period of time between the cultures ordinarily?

THE CHAIRMAN.— I should say a matter of two or three days, as a rule.

MR. NEWCOMB.— Is that rule applied in private practice outside of the hospital?

THE CHAIRMAN.— At the hospital they require three negative cultures in succession before they discharge. The cases which we are now talking about are the cases outside of the hospital in private practice.

DR. UTLEY.— Are these two negative cultures taken by your medical inspector, or does the physician in attendance take the first negative culture?

THE CHAIRMAN.— The attending physician is to take one culture, and the second culture is to be taken by one of our officers.

DR. BROUGH.— I would like to say I heartily agree with the taking of two negative cultures; but, when we consider the cases of diphtheria in the city of Boston in the year 1895, there were reported to the city Board of Health some 4,000 cases, but the examinations of the bacteriologist showed only 1,500 positive cases in the city. That left about 2,500 cases in which there was no positive culture; but those cases were reported as diphtheria, the houses were placarded as diphtheria, and every precaution was taken as if they were. Of course, a certain number of that remaining 2,500 went to the hospital perhaps, reducing the number of cases which were not examined bacteriologically, so that enough were proved to be diphtheria to make about 40 per cent. It seems to me, while the necessity of taking cultures in the last stages of diphtheria is necessary, it would be perhaps a good thing if the physicians, in the early stages of the disease, would send in their cultures for diagnosis, because, when we look over cases that are inspected by the Board of Health, we find a

large number of those cases that are reported as diphtheria, for instance, reported to-day and received to-morrow, and a culture is taken that are proved not to be diphtheria. They are treated as diphtheria while really they are not. Possibly, by taking the culture the patient is detained in the house a longer period of time (from the fact that his throat is clear he thinks he is perfectly well) and the children kept away from school; but the whole thing could be obviated if the physician, in the early stage of the disease, would send the culture to the Board of Health, and it would be found that some of those cases which are thought to be diphtheria are not really diphtheria. The error, I believe, in bacteriological diagnosis is not more than 10 per cent.; while in clinical diagnosis there is certainly a very much larger percentage of error.

Dr. Lincoln Chase.— Mr. President, in Brookline, where I live, I think that the board is not troubled very much in the way Dr. Brough has stated. They are very glad to have the assistance of three bacteriological examinations, and almost every case of tonsillitis receives bacteriological examination. The expense is distributed to all the tax-payers; and no one seems to have any objection to bringing in the culture, which makes it very convenient for the physician to send them in. Last October I had a little experience myself with diphtheria, with a little girl, a very severe case. A physician was called in the week after the beginning. I came down myself in two or three days with diphtheria, and had it severely. The germs lingered in my throat and nose seven weeks all together,— four weeks in my throat and three weeks longer in my nose. Dr. Stein was attending me. We took the precaution to wait until I had three successive negative cultures made before I released myself from the room which I had stayed in during my illness. I think that is a very safe practice; and it is the usual practice, I am informed, at the City Hospital. But I did it because I think a physician should be specially careful to set a good example in those things.

We require the time limit in Brookline in which the first culture is made. We ask the physician to have a bacteriological examination made four weeks after the commencement of the case, unless there is some reason for haste in making the culture; for otherwise the phy-

sician and family are doomed to disappointment in a great many cases, where a large number of cultures is made, and we do not think it has a good effect. The physician gets discouraged, and may slight the examination in his zeal to get through with the case.

I would like to ask Dr. Hill through you, Mr. Chairman, about how long a period usually elapses before he gets the first negative report from the examination? Is it two, three, or four weeks, or what number, as a rule?

DR. HILL.— There is no fixed rule. It varies with almost every case. I have not made up the records so as to show that. It is a rather difficult point to determine.

DR. CHASE.— It will be interesting when the doctor does read that record as a whole. It seems the germ is rarely absent in less than three weeks. We have a time limit requiring one bacteriological examination. The next can be made in the ordinary time, if he chooses.

THE CHAIRMAN.— If we were to require a time limit of four weeks in every case, we should hit a great many cases in Boston where the poor fellow has been pronounced a diphtheria patient when he has no diphtheria; and, if in addition to that imposition, we should keep him four weeks before we take a culture to see whether he is free from diphtheria or not, I am afraid we should impose a severe hardship. Undoubtedly, it would be a more correct plan to send a competent officer to verify the diagnosis, and to make it sure by a bacteriological test in every instance.

DR. CHASE.— Mr. Chairman, allow me to correct a misstatement I think I made. It is not that we require four weeks before the first culture is made. The final disinfection by the board is not made until four weeks from the commencement have elapsed.

THE CHAIRMAN.— We can but wish that the more correct method might be put in practice and adhered to, just as we do in cases of small-pox. In that disease, as soon as a case is reported, we send an expert to verify the diagnosis. I think it ought to be so in other infectious diseases, but it would impose a very large amount of work and expense upon the department.

DR. ABBOTT.— I am very glad to hear this paper, which is valuable to every local board of health, especially because it treats

of the one subject that is the most important to-day to boards of health; that is, the management and control of infectious diseases. The State Board of Health has no right to issue regulations upon this subject. The laws give it no such power. The power to make regulations lies entirely with the local boards. I do not know anything that has been more troublesome to local boards of health in the last few years than this question of cultures of diphtheria. I have had a great deal of correspondence with local boards of health on the subject, and it is one of the most perplexing things. Another thing is the period of time that elapses before bacilli disappear from the throat. The longest time that we have observed was twenty-one weeks,—a pretty long time, almost half a year.

I will state for the information of members here something in regard to the work which the board is now doing in this matter. Some two or three years ago the board decided to establish a bacteriological laboratory and make diphtheria cultures for those boards that have no facilities of the sort for themselves; and, during the past year, the work has increased considerably over the year before, although it is not yet very large. The whole number of cultures made in 1897 amounted to about 2,200, and it has demonstrated that the work can be done over a considerably large territory. Some five or six hundred of these have come from distances of over fifty miles; and several hundred cultures came from a distance of over one hundred and fifty miles, as the remoter parts of Berkshire County.

The laws in regard to infectious diseases in this State have become more certain and definite. It is charged against us very often by scientific persons that medicine is an inexact science, that we do not know anything with absolute certainty. But it is becoming more exact every day, and this question of diphtheria cultures is one process by which we are bringing such things down to a more mathematical standpoint. For more than seventy years in this State physicians have been required to report infectious diseases, and yet no actual notice has been taken of the law, at least very little practical use has been made of it, until within the last ten years, when, perhaps, some board of health applied a penalty; and the moment you apply a penalty people begin to find the practical value of the law.

We now have notices of infectious diseases from nearly every small town in the State, which are sent in to the State Board of Health; but there are comparatively very few small towns where public bacteriological work is done by the local board of health. The city of Boston, the cities of Worcester, Lowell, Fall River, Springfield, and nearly all places having over twenty thousand inhabitants are now conducting their own bacteriological work, and making diphtheria cultures from their own population. It is certainly better for it to be done in the town itself than by the State Board, because the answers can go much more punctually and quickly; and physicians are always better satisfied to get them quickly than to wait one or two days, as they are obliged to when they send them one hundred and fifty miles even, and do not get them perhaps until thirty-six hours after the taking of the cultures.

There is one point I have often thought of; that is, how many people exist in the State with diphtheria bacilli in their throats and are not aware of their presence, nor suffer with actual illness. You go into a family where there is diphtheria, you find the children very ill, and find the bacilli very abundant. You examine other members of the family who are apparently well, but you find the bacilli in their throats also. They got them from the sick children.

DR. MILLER.— Mr. Chairman, Dr. Abbott just made the remark that this subject was very important to boards of health. It seems to me that it is of very great importance to the practitioner; and I would like to ask if the State Board of Health has power to send an officer out to examine a case of supposed diphtheria upon application of a physician out of the city. It seems to me something of that kind would be an advantage.

DR. ABBOTT.— Simply as a matter of investigation, but not as a matter of executive authority or compulsory examination.

DR. MILLER.— In many towns there is no elected board of health; but the selectmen by virtue of their office, if no board of health is elected, serve as a board of health. Sometimes the chairman of that board, as the only qualification that he has for the office, has an extremely large bump of self-esteem; and it is often very annoying to the practitioner in cases of that kind. My observation within the last two or three years has been that a great many cases of ton-

sillitis, more particularly tonsillitis, were said — I suppose by some outsiders who had nothing to do with the case — to be diphtheria; and, consequently, when the practitioner felt positively sure that it was not diphtheria, he was very much annoyed. Now it seems to me that it would be a good law, a very good one, to authorize the State Board of Health to send out an officer to decide all such cases. I think it would be an advantage; and, if we have not any law that meets that point, I do not know why it would not be a good thing for this organization to make an effort to have such a law passed covering the whole State. As I first said, there are a great many cases of tonsillitis that are said to be diphtheria; and particularly if the board of health, which has no medical knowledge apart from the health officer, does not like the physician, it often makes considerable trouble and considerable talk.

DR. BUCK. — Mr. Chairman, I would like to have the board emphasize the suggestion made by the speaker before the last in regard to the importance of bacteriological work being done in the town where the report is at once needed. In some of the outlying cities and towns near Boston the returns are, of course, satisfactory when they reach the locality; but in Fall River, where we have had some experience in waiting two or three days for the report, it is found advisable to employ a local bacteriologist, and, unfortunately, the state of politics was such that objection was made to the slight expense incurred by the employment of local workmen. The importance of it is apparent to every one, the importance of the immediate report; and I think, if the State Board could add the weight of their authority to that local bacteriologist, it would be a help to local boards who are desirous of carrying out the work on the ground.

MR. BUCKLEY. — Mr. Chairman, I would like to ask you if there is any stated time in Boston when you fumigate cases of diphtheria, or do you fumigate after you take the second negative culture?

THE CHAIRMAN. — As soon as the second negative culture is reported, an officer is sent to disinfect the premises.

MR. BUCKLEY. — I understood that the doctor from Brookline made the remark that fumigation was not insisted on until after the fourth week. It seems to me there is a vast difference between theory and practice in these cases. There might be some mild cases of diphtheria where a poor man has a family dependent upon

him, and the man might recover perhaps within a few days, within a week or a week and a half; and it strikes me it would be hardly practicable always to wait four weeks before fumigation was indulged in, and the man to be restrained from his work and wait that length of time. I was not aware that there was any stated time anywhere. I supposed it depended on either the second negative culture or that the appearance of poison had left the system.

DR. CHASE. — Well, Mr. President, where requests are made by the attending physician, not after two or three days, but after two or three weeks have passed, if the negative culture had been obtained, the boards have never declined to have disinfection at once; but, if we have believed that one negative culture was not enough to show that there was no longer danger, we have insisted on the time limit in the case of three or four weeks.

DR. PRESCOTT. — Mr. Chairman, it seems to me the time limit in any case of diphtheria is hardly practicable or necessary, because some cases have been sent to the south department of the City Hospital in twelve days from the time of admission, and three negative cultures have been taken. Therefore, some cases are ready for release from isolation at the end of twelve days from the time the first positive culture is taken. I agree with Dr. Brough that a great deal of trouble might be saved if before a case is reported as diphtheria the physician should wait for a positive culture from the laboratory: but during that time he should treat the case, as far as isolation is concerned, as a case of diphtheria, limiting thereby as much as possible the danger of infection.

I would like to ask if you, or Dr. Hill, or any one, knows how many cases have been at the south department where a positive culture has been found on the third culture being taken after two negative cultures. In other words, what the necessity is for the third negative culture.

THE CHAIRMAN. — Perhaps Dr. Hill has that information, and can give it to you.

DR. HILL. — In speaking to Dr. McCollom on the subject, he said he simply required three cultures, and that no case ought to be released on less than three, but he did not say anything that would answer your question. However, in our work we have found already, out of a few cases where a third culture happened to be

taken, at least one case where the two negatives were followed by one positive, so that to have two negatives is not absolute by any means. We do not claim that at all, but simply that it is an advance on previous methods.

DR. PRESCOTT.— Then I would like to ask another question. How as to a case, doctor, in which two negative cultures were taken, and they were absolutely free of diphtheria, where a competent man looked upon it as diphtheria, and so pronounced it?

DR. HILL.— I do not know that we have had many of those cases, doctor. In one case, however, this difficulty occurred. The doctor stuck to his diagnosis like a man, and said he was perfectly certain it was diphtheria. He sent culture after culture, and some of those went over to Harvard, and were found negative there also; but he got another man, perhaps more expert than himself, to take a culture, and it came positive at once, and ran positive after that for some weeks. The fact was the doctor's first negatives were futile endeavors on his part.

DR. PRESCOTT.— Why I asked that question was, I know cases in which the clinical diagnoses of diphtheria have been sent to the south department, and the clinical diagnosis there was diphtheria. The cultures taken at the south department, which, I suppose, were taken without any technical errors, were never positive, never got a positive culture. The case goes down, though, as a case of diphtheria; and I wanted to know if there were any rule of the board of health which would cover that point.

THE CHAIRMAN.— When a physician reports a case of diphtheria, that is at once regarded as *prima facie* evidence that it is diphtheria; and it is so put down on the books. That may be followed by a culture which is negative, or a dozen negative cultures. If the physician still persists that the appearance warrants him in calling it diphtheria, the board of health must receive those reports as official, and minute it as an official case of diphtheria. The board of health can stand that sort of thing just as long as the family and attending physician can.

DR. PRESCOTT.— I do not think that answers the question. I should not think it was a case of official diphtheria. I should think it was a case of physician's diphtheria.

THE CHAIRMAN.— This law requires that, when a physician finds

a case of diphtheria or other case of infectious disease, he shall report it to the board of health. He is under a threat of penalty unless he does it; and, when he does it, the board of health is obliged to regard it as a case of diphtheria. When the attending physician is ready to release his patient and we find two negative cultures, we disinfect and discharge the patient. If in spite of the bacteriological test the attending physician persists that it is a case of diphtheria, we wait.

DR. PRESCOTT.— Then I will put the question in another way. If he gets two negative cultures and says it is not diphtheria, will the place be fumigated, although there is no clinical diphtheria?

THE CHAIRMAN.— We go and disinfect at their request.

DR. PRESCOTT.— Then if he gets two,— I am asking simply for information,— then if the physician gets two negatives cultures from the board of health, he can send a request to the board of health to have the place fumigated and the patient released from isolation?

THE CHAIRMAN.— We go at once and offer to disinfect as soon as that second negative comes in; but, if on arriving there we find that they persist that it is diphtheria from any appearances whatever, we should retire, and allow them to have diphtheria the rest of the year in isolation.

DR. PRESCOTT.— But suppose they do not want it? Nobody wants diphtheria.

THE CHAIRMAN.— But we are presuming that they do want it, by the official statement.

DR. MILLER.— Mr. President, I would like to ask about what proportion of cases (of course there are some) of supposed diphtheria prove not to be, when cultures are taken. There must be some proportion. That is, it is often the case, particularly in the country,— and I presume you have some in the city,— that a physician thinks he has got a case of diphtheria, when the culture proves that it is not. Now can you give us any idea of the proportion of those cases of supposed diphtheria that are not diphtheria?

THE CHAIRMAN.— I do not think it would be possible for me to state what that proportion is, but we are aware of the fact that a considerable percentage of the cases reported as diphtheria do not turn out to be such.

DR. BROUGH.— By looking hurriedly over the report of cases,

those that were reported by physicians as clinical diphtheria and those sent up to the City Hospital, I have made a rough comparison between clinical and bacteriological diagnoses. In the month of January of this year there were some 201 cases of diphtheria reported, and I think perhaps 70 of those went to the hospital or were investigated bacteriologically by the board of health. Out of those 9 proved to be "not diphtheria." During the month of February there were 141 cases reported, and I think some 44 of those had cultures taken; and 7 of those were proved to be not bacteriological cases, although they were reported clinically by the physician as diphtheria. In March there were 149 cases, and I think some 70 or 80 were investigated bacteriologically; and there were 5 cases which proved not to be diphtheria. In April there were 143 cases. I think some, half at least, were investigated; and 5 of these were not cases. During the month of May there were 114 cases that were reported as diphtheria clinically by the physician. Forty-seven were investigated, of which 12 proved to be, bacteriologically, not cases. During the month of June some 83 cases were reported; 40 were investigated, and 9 were not cases. During July there were some 81 cases reported, so far; and 4 of these were not cases. I think some 20 perhaps went to the hospital. That is to say, practically, 50 per cent. of the cases were investigated bacteriologically. Out of that 50 per cent., 20 per cent. proved to be not diphtheria which were clinically reported as diphtheria, but which were not bacteriologically. I have no statistics further. But in 1895, when 4,000 cases were reported to the city, there were perhaps about 40 per cent. of those which were never proved to be bacteriological diphtheria; and it is nearly the same in subsequent years, but the bacteriological cases were very much smaller in number than those reported clinically. And of those cases reported clinically, when the number of cases came to be investigated, it was found that perhaps anywhere from 15, 20, or 25 per cent. were not really diphtheria.

Mr. Newcomb.— Mr. Chairman, in regard to this culture question, there is one point we meet in Salem; and it may be proper to introduce it. Sometimes the answer is returned to us, "No growth"; and I would like to ask either you or Dr. Hill what "no growth" means.

Dr. Hill.— "No growth" cannot be regarded as a negative cult-

ure, because "no growth" usually means simply that either the serum becomes too dry for anything to grow on it or bacilli of some kind have got in, which have spoilt the serum. It is not really logical to say "no growth" in any case, although it covers the case very well, because there often is a growth; but at the same time the value of the serum is destroyed, and therefore it is impossible to make a satisfactory examination. That is what is really meant by "no growth." Of course, it is not said whether the thing is negative or positive. It simply leaves the question open, and will never be accepted as a negative culture. Serum from the most healthy throat will almost always yield a growth of something,— bacteria, fungi, etc.

I wish to say to Dr. Prescott (I think his question has reference to two negatives being obtained during an attack of diphtheria, if I understood his question, what would then be done with the case?) we require two cultures negative "after the membrane has disappeared." So his objection could never take form, I think, if I understand him rightly.

Dr. Prescott.— Will not take form! Should not take form, perhaps; but it has taken form in a great many cases in Boston, and a former city physician was very positive in his statements that no case should be reported as diphtheria without a positive culture, and that was the reason that I wished to know what the board of health's opinion was at the present time. It seems to me that there are certain cases in which no positive culture is ever obtained, but in which the disease, as far as the most competent men can make them, or men who have had many cases of diphtheria, is judged to be diphtheria, and the men who in their bacteriological work have looked upon diphtheria as simply the presence of K. L., as they are called, in the throat, and, when they get clinical experience, look upon it as the presence of membrane in the throat. It seems to me the board of health should have some definition as to what is diphtheria, and that is the reason I asked the question.

The Chairman.— I should like to answer that question, of which I did not catch the drift. In the first place, we are obliged to recognize, as I said before, the report of the physician as an official notice warranting us in placing it on the book as a case of diphtheria. So long as any clinical appearances remain in the throat

warranting a suspicion of diphtheria, I think we are warranted in regarding it as a case of diphtheria. When the membrane or other appearances have disappeared, I do not think we are warranted in calling it a disease, diphtheria, even though the bacilli remain, but a case dangerous to public health, and warranting our insisting upon isolation until two negatives have been received.

Dr. Shea.— Mr. President, it has happened in my experience that a child has had diphtheria and the case has been sent to the hospital. We have taken a negative culture, and it comes back to us occasionally not a case. But I think the physician should be encouraged; and I, for one, always encourage physicians to report their cases of diphtheria, if they think they are diphtheria. I think any physician in Boston that will go to the trouble of reporting a case of diphtheria always considers it as such. If the case is not one, the family, as a rule, are very quick to know it. They will either change the physician or they will ask the physician to take a culture. I think physicians of this class should be encouraged to report their cases. No harm can be done, as a rule, other than at least a disinfection, which accomplishes some good in case the patient has not diphtheria; and I think, in the great majority of cases that have been reported without any culture, no harm has been done. From the mere fact of the physician reporting that case we gain probably two days. The case is immediately isolated. Whereas, by the physician calling on the bacteriologist, he would wait two or three days; and that means that most of the injury has been already done. Immediately, when a case is reported by the physician, that case is isolated, it is investigated; and, if there is any question of the diagnosis, it is referred to the department for a culture, which sometimes is necessary. I think that is the great feature in our work. When a case is reported, we can commence to act. We can give the bacteriologist a chance and the disinfector a chance; and, if that is done, I do not think any harm is done, but a great deal of good is accomplished.

Dr. Jackson.— Mr. Chairman, the prevention of the spread of diphtheria has been discussed very fully indeed from the standpoint of bacteriology and also from the common-sense standpoint; but there is one point that has been brought very strongly to my attention. I practised medicine in one of the rural towns of Massachu-

setts, quite close to Boston, and some of the local cities surrounding Boston. It is the custom in Boston, I am quite sure, and also in these local towns and cities, to collect all the swill. Now this swill is gathered from every house; and in these houses where there have been cases of diphtheria, the children convalescent from diphtheria, there are oranges, the peel of oranges and fruit which are thrown into the garbage pail, and this is collected and deposited in one place in the city. Then it is sold to farmers. These farmers come down from the towns with their carts, and they gather this swill. They buy it for so much a cord: it is carted to their farms. On the way in transit more or less of this is jolted out of the carts, and the remainder is generally deposited near their pig-pens. My attention was first drawn to this fact five or six years ago, when I had an isolated case of diphtheria on an apparently healthy farm. The farmer had carted this swill. A domestic animal, a cat in that family, probably being hungry, had fed from the swill-pail. It had contracted diphtheria; and the child, petting this cat, contracted diphtheria from the cat. I am quite sure that animals feeding from these pails of swill will contract diphtheria. The object is, of course, prevention of diphtheria. In the discussion of this very important subject we want to begin at the first point; and, if the lawmakers of Massachusetts are going to make one law to cover diphtheria, then, on the other hand, to come round to this law, and say that the citizens shall be practically incarcerated in their own homes, so that the disease shall not be spread, I am very sure that law is at fault. I understand that the city of Boston will cremate their garbage. It is the thing, and the only thing, to do. Failing to do that, the various towns, and also the city of Boston, should be obliged to dispose of that garbage in some other way than selling it to farmers, that the farmer's child shall not contract diphtheria.

THE CHAIRMAN.— Are there any further remarks to be made upon this paper? If not, I will ask Dr. Hill to close the discussion.

DR. HILL.— All I can do is to attempt to answer some of the questions that have been asked. In regard to Dr. Abbott's question as to the number of healthy persons that have bacilli in their throats, Dr. Biggs, of New York, made a number of investigations two years ago. I have forgotten the exact figures. He found that about 1 per cent. of people in good health presented bacilli in their

throats: but at the time there was an extended epidemic of diphtheria going through the city, so that his results do not throw any great doubt upon positive diagnoses, so far as this point is concerned.

The percentage of the total cases reported which are sent in for diagnosis is a question which cannot be answered, as far as I know, from the records at the present time, because they have not been made out with that object in view; but I may say, bearing on the question to some slight extent, that, of the cases examined by us, only 22 per cent. of the new cases sent in for diagnosis proved to have diphtheria bacilli present. Of course, that does not mean that the physician expected all the other 78 per cent. to turn out diphtheria: in many cases the clinical diagnosis showed tonsillitis or something of the kind; but it simply shows that, of all the cases, only 22 per cent. of the cases were positive.

The proportion of cases considered not diphtheria by the physician, demonstrated to be diphtheria by us, it is also impossible to give at the present time; but it is probable that there is a larger proportion of cases that are demonstrated not diphtheria than cases which are shown to be diphtheria. That is, our reversals of the physician's diagnosis decide more often in favor of the patient than otherwise.

In regard to the time involved in the examination, the quickest time that a physician can get a report from us is fifteen hours. That is to say, if we get the culture at six o'clock at night, we are ready to report by nine o'clock the next morning, as a rule; and, if he rings us up on the telephone, he can get his report within fifteen hours. There is a method by which a report can be got in six hours,— that is, if a positive result is obtained, but, if it is not positive after six hours, a negative report should not be given, until the regular examination at the end of fifteen hours is also made.

In such a case one may place one's self in the position of having reported a case negative after six hours, and then nine hours later having to call up the physician and tell him it was positive, after all. This seems a reflection on the bacteriologist, although, really, it is unavoidable. I do not remember any more of the questions asked.

The meeting then adjourned.

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